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BELL TELEPHONE QUARTERLY

JANUARY, 1924

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ORGANIZATION CHANGES

ABSTRACTS OF RECENT TECHNICAL PAPERS FROM BELL SYSTEM SOURCES

NOTES ON RECENT OCCURRENCES

American Telephone and Telegraph Company
New York

Part of the American Telephone Historical Collection

BELL TELEPHONE QUARTERLY

A MEDIUM OF SUGGESTION
AND A RECORD OF PROGRESS

Published quarterly for the Bell System by the American Telephone and Telegraph Company

Subscription, $1.50 per year, in United States and Canada; single copies, 50 cents

Address all communications to
INFORMATION DEPARTMENT
AMERICAN TELEPHONE AND TELEGRAPH COMPANY
195 Broadway, New York

Vol. III JANUARY, 1924 No. 1

The Achievement of Telephone Pioneers

From an Address at the Annual Meeting of the Telephone Pioneers of America, in Atlantic City, N. J., October 19, 1923

FROM my earliest years I have been greatly interested in pioneers. When I was born and where I was brought up pioneers of the traditional sort were not very remote in time and their outlines were not so indistinct as they are today. In the sixties we were nearer to Colonial conditions than we are now to those of the sixties. Then pioneers were in the air, so to speak. Pioneer stories were the stock of our childhood and pioneer memories surrounded us. I was born within a few miles of where that daring adventurer, Daniel Boone, lived. I ventured into the southwest where Crockett's rifle blazed a path of civilization, and I have looked for the footprints of other daring characters in almost every State of the West.

These people have appealed greatly to my imagination. I have thought with admiration of those lean, stern men, meagrely clad, with the axe as their principal implement and the rifle as their weapon, journeying into the unknown, preferring the adventure, facing and controlling wild men and the evil elements of a wilder nature. These are the men whom the word "pioneer" called to my mind.

And so when I was told that I must come to Atlantic

City and meet many hundreds of pioneers, I was greatly interested, not to say excited and somewhat terrified. I have come and I have seen them. I am still timid, but my picture does not seem to fit. You may be adventurers. You may be pioneers, but you do not look —at least all of you do not—like Daniel Boone, or Davy Crockett, or Abraham Lincoln.

I realized that I might be disappointed, and it occurred to me to ask whether those men were really pioneers, or whether there was not another sort of pioneer —to discover, in short, what the word "pioneer" really means. It is remarkable how we continue to imagine that we know more than we really do and to use words continually without having disturbed ourselves to inquire how they originated and what they signify. And so for the first time in my life I turned to the dictionary and did some pioneering of the word "pioneer." I discovered, to my satisfaction, that it means primarily and mainly by origin and general use elsewhere than here, a foot-soldier, one who goes with or before an army to clear obstacles out of the way, to dig trenches, to build bridges, and to lay foundations.

Pioneers Foot-Soldiers of Industry

Therefore, by necessity, I shall have to think of you as pioneers in the original sense of the word. I do it also by preference. I prefer to think of you as soldiers and as foot-soldiers. A soldier is one who dedicates himself to his country and who is ready to give his life for his nation's flag. The first requisites of him are loyalty and a willingness to sacrifice himself for something outside of and bigger than himself. And the foot-soldier is the one who does most of the fighting and most of the dying.

As pioneers you have been fortunate, more fortunate than most pioneers. As a rule they have not entered into the promised land. They have seen little except the obstacles, the swamps and the wreckage, and the hurrying feet of those for whom they prepared the way.

They have not seen the peaceful, prosperous community, the flourishing enterprise, and gigantic structures which their labors have made possible.

But what do you see, those of you even who made the first start? What sort of a structure have you erected? Let us examine its leading features.

Magnitude of the Bell System

The Bell System is, I believe, the biggest private enterprise in the world. At any rate, it is one of the two biggest. It and the Steel Corporation are certainly the biggest private enterprises in the world; and in capital stock, annual expenditures for new plant, and number of stockholders, the Bell System ranks ahead of the Steel Corporation. Its investment in fixed capital is at present only slightly less than that of the Steel Corporation; and in making comparisons one should remember that the latter in the main sells products, while the Bell System sells only services.

The scale of operations of the Bell System is governmental in its magnitude. Its total expenditures in 1922 were greater than the pre-war expenditures of any governments in the world except five and were nearly the same as the pre-war ordinary expenditures of our Federal government. They exceeded those of such governments as Austria, Hungary, India, Italy and Japan, while its expenditures for additions and replacements were larger than those of any governments except eleven, larger than those of Spain, Argentina, Canada, or Brazil.

It has 14,700,000 owned and connecting Stations, or nearly 61% of all the telephones in the world. It has provided facilities for communication by word of mouth which are within relatively easy reach of any individual in a nation of a hundred and ten millions of people. It is a great and comforting unifying factor. It has more contacts than any other agency in the world. Its nearest competitor is our Postal Service, but it carries only thirteen billion pieces of first-class mail matter

a year, while the Bell System has eighteen billions of conversations; and, for comparison, this figure must be doubled since the answer is coincident. It has helped to make American business the most fluid in the world and its processes the quickest and the most dependable.

It expends more for research in its endeavors to make improvements and to lessen costs than any other private enterprise. It does this because of its eagerness to invent new and better ways of doing things and to utilize for the public all the valuable discovereies in its field of communication. The Bell System has not only eagerly studied and availed itself of the discoveries in science bearing on telephony, but it has also been prolific of inventions and a very nursery of them.

Its organization itself is distinctly American in structure. It presents an analogy to that of our government. It suggests a federated republic. It has its central organs, but it has also its regional units, maintaining intimate contacts and sympathetically administering to local needs.

Bell System a Democracy

The Bell System is more democratic than any other private undertaking in the world in respect of its ownership. It is the most popularly owned business and its ownership is more widely distributed. Its growing army of owners is a literal cross-section of American society. It has its big owners, of course, but the twenty largest holders of its stock own less than five per cent. of it, and the average ownership is only twenty shares. This army includes not only bankers, brokers, lawyers, clergymen, teachers, newspapermen, manufacturers, merchants, and government employees, but also bakers and barbers, blacksmiths and boilermakers, carpenters and chauffeurs, cooks and waiters, housemaids, housewives and farmers. These and others of the everyday working men and women of America make up the army of owners of the Bell Telephone System.

Bell System Ideals Are High

But all this belongs to the material world. Certainly the Bell System is big; but mere bigness is not necessarily great or wholesome; and neither is it, as some people seem to imagine, necessarily baneful or menacing. Everything depends on its nature, its ideals and purposes, in short, on its spiritual quality. How does the Bell System stand spiritually? Does it meet the tests?

Men whom I greatly respect, outsiders who have no reason to be biased and of whose competence and independence I have knowledge, have written to me and said to me that the Bell System in their judgment is the cleanest and best managed big business in the world. I have had some opportunity to form a judgment in the matter. And I am prepared to say that I know of no other which can be rated above it. I know of no other enterprise, private or public, which has higher purposes or sounder ideals of service. The Bell System has seemed to me to be honest in its purposes and endeavors and clean in its practices. It is aboveboard and frank. It puts its cards on the table. It welcomes government regulation and cooperates cordially with government agencies. It believes in the integrity of American institutions and in the honesty of purpose of American official servants. It cooperates with them to serve the public.

It seeks to be fair to its owners, its employees, and its consumers. It has as its primary or guiding principles to keep its business on a sound and conservative basis, to give to its owners a fair return on their investment, to render to its consumers the best possible service at the lowest cost; and it succeeds in giving them a service which is worth to them very much more than it costs them.

The Bell service is public minded. It is democratic in its responsiveness to public sentiment and needs. It evidences in as high degree as any other agency I have known a concern for the public welfare. Its personnel is animated by a spirit of service.

Bell System Could Not Exist Elsewhere

Such a system, I believe, could not exist anywhere else in the world. One of such magnitude certainly could not exist elsewhere. There are larger nations in the world than ours but none with a comparable area with the requisite underlying conditions for such an institution as the Bell System. Russia is bigger than the United States, but 83% of her people are illiterate and disabilities of many other sorts are inherent in the life and institutions of her people. Even if an area containing all the literate peoples of Central and Western Europe were considered, such a system could not there be developed. Waiving the differences in language, hostile states of mind and national restrictions, there would still be too many handicaps.

Among even the more highly developed nations of Europe, the telephone habit, such as we know it, does not exist, and the stimulus for its development is wanting. The people of Europe are not in a hurry. Why should they be? "Watch Us Grow" communities do not exist in Europe. The people there have been doing business at the same old stand in very much the same old way for ten or twenty centuries. And they will not change suddenly. Near at hand in every community there is a monument which has been there for over two thousand years. It will be there for two thousand more. It is a constant warning that the more things seem to change the more they remain the same. In one of the countries I visited this summer I noticed over the gate entrance to a noble place that has lost ground in the last six hundred years, this motto in Latin: "It is not for me to change." Nearby there was a wall several thousand years old enclosing a space in which there was a modern building erected by William the Conqueror. Why should the people of Europe hurry?

And the people there of one community are not much interested in those of another. They are more than provincial. They are rooted to the soil, to their

villages and the surrounding farms. I saw in the provinces of France not a few men whom, as I told my companions, Cæsar seemed to have overlooked. The radius of interest and action of perhaps from two to four per cent. of the people seems to be fixed by the railways and the automobiles; of another ten or fifteen per cent. by the bicycle; and of the remainder by a cart drawn by a horse, or by a horse and a man, or by a man and a dog or by a man and a woman, or by a woman and a dog. If a man cannot get a dog to help him he is not too proud to take a woman.

Europe's Provincialism

It is singular how errors arise and persist. It is common for Europeans to speak of Americans as provincial and of Europeans as cosmopolitan, and for Americans to repeat it. The reverse is the truth. When people speak of Europeans as being cosmopolitan, they are in reality speaking of a small fraction, in some countries as low as one-half of one per cent., which constitutes the upper or ruling class. In America, democracy travels. In Europe it does not. On the Continent of Europe, outside of a few small countries such as Switzerland, Denmark, Norway and Sweden, it does not exist. In Europe there is very little intercommunity interest and contact. In America the population is mobile and widely interested. Over a third of the entire population of the United States does not live in the State in which it was born. I believe that there were more Americans in France this summer than there have been Frenchmen who have traveled far afield from France in over ten years.

Again, there is on the Continent of Europe no such concern for the average man as exists here. America has been and is a conspiracy on behalf of the average man. And there is, therefore, in Europe no such responsiveness to public sentiment and desire to satisfy public needs as we find in America.

Finally, there does not exist in Europe that freedom of enterprise and individual initiative which are prerequisites of development and efficient operation. There the deadening hand of State ownership and operation rests heavily in particular on the telephone industry. In Great Britain, with a population nearly one-half that of the United States, with a density which should make for large and cheap telephone development, there are not as many telephones as there are in New York City and the rates for service there which is slow and reaches only a few people would be regarded as prohibitive here; while in France, telephoning is little more than an adventure in a complex of silence and blasphemy.

The Future and Our Responsibility

You have been fortunate in having such a country as the United States of America in which to do your work. You have erected a noble structure. You have builded magnificently and wisely and have imposed a terrible responsibility on those of us who have taken up your tasks. These tasks will not grow less. No one can now adequately picture what the future holds. The System is not perfect. We know that. It is our task to make it more perfect as we extend it. One of the greatest handicaps from which we are liable to suffer in view of past performance is complacency, and therefore, I think it is our duty to cultivate a reasonable discontent with ourselves and to try to see ourselves in the service as the public sees us. To those of the present generation I would say, seeing that we are surrounded by so great a cloud of witnesses, let us run the race that is set before us with patience and strive to perfect not only the work but also the lives of those who have so greatly wrought.

D. F. Houston.

Some Characteristics of Foreign Telephone Service

TELEPHONE history is filled with many a record of heroism and devotion to duty on the part of operators and other telephone men and women. In flood and fire, in riot, earthquake and epidemic, telephone workers have remained steadfastly at their posts and have kept open the vital lines of communication despite all hazards. American readers are naturally most familiar with incidents of this sort which have occurred in connection with telephone service in the United States. But it behooves us to remember that no country has a monopoly of courage, that devotion to duty is not exclusively an American characteristic.

The Right Spirit

In 1918, when a world-wide epidemic of influenza was adding its toll to the stress of war, an instance of self-sacrifice on the part of a telephone operator took place at a small exchange in New Zealand. The incident was cited at the time by a speaker in the New Zealand Parliament. Eloquently he described how this girl "stood staunch while people were falling sick and dying all round her," how "throughout the whole epidemic she worked from twelve to fourteen hours a day." The central office at which this operator was employed, the speaker said, "opens at eight o'clock A.M., and closes at ten P.M., and all that time the girl was there on duty. I know the circumstances," he added, "because I myself had a great many messages to put through, and she, like the brave little British soldier she was, remained cheerily at her post all the time."

The maintenance of telephone service in that emergency, when there were frequent hurry calls to doctors, nurses and druggists, must have meant much to the community. The operator who toiled on for twelve to fourteen hours every day, while herself exposed to the

deadly epidemic, deserves all credit. But what of the unfortunate telephone subscriber whose need of medical assistance happened to occur after the telephone exchange closed at 10 P.M.?

America's Exceptional Telephone Service

To an American there is something anomalous in the thought of a telephone exchange suspending operations at night. In the United States "telephone service" means "continuous service." With negligible exceptions, every telephone subscriber in this country receives service night and day, Sundays and holidays included, as a matter of course.

It is a mistake, however, to regard American telephone service as typical of telephone service throughout the world. Compared with conditions in other countries, American telephone service is a wholly exceptional service. It is exceptional in the extent to which it has been developed, and in the distances over which it affords communication. It is exceptional in the speed and excellence of the service given. It is exceptional in that it is always ready to serve, and never shuts up shop for the night, for a day off, or for luncheon.

Night Closing of Exchanges Abroad

In most other countries the standards of telephone service are very different. To be sure, continuous service is frequently given in national capitals and in large commercial centers abroad, but outside of important cities all-night service is quite unusual.

The percentage of the total telephone exchanges at which continuous operation is maintained varies considerably from country to country. Of course, detailed statements as to telephone service abroad are subject to variance, due to innovations effected from time to time. The latest available data, however, represent general

conditions with an accuracy which is probably not substantially affected by any still more recent changes.

New Zealand, which, despite its growing cities, is still predominantly an agricultural community, maintains continuous telephone service at approximately 18% of its central offices. In Europe, however, even such highly industrialized nations as Germany and Belgium enjoy uninterrupted service at less than 5% of their total telephone exchanges; and in France the proportion of central offices in continuous operation is lower still,—considerably less than 1%. The hours of service at most of the exchanges in the Italian, Norwegian, Swedish and other Continental telephone systems are similarly restricted in varying degrees.

Similar Conditions Before the War

Nor do the limited hours of telephone service in Continental countries represent in any sense an abnormal condition, or a symptom of the post-war depression in the economic life of Europe. Even before the war the proportion of telephone exchanges giving continuous service was about the same as now in both France and Belgium. In 1913 a speaker in the German Reichstag complained that a city of 30,000 population was without telephone service after 9 P.M. In fact, the closing of the lesser telephone exchanges at night has long been practiced, not only in Europe, but in New Zealand, Australia, South Africa and elsewhere to such an extent that it may fairly be said to be typical of most foreign telephone services.

Practically the only exceptions to this rule among foreign countries are Canada and Great Britain. In the matter of extending to telephone users the advantages of continuous service, the British telephone system was far in advance of most of the Continental systems even before the war, the development of the local service having been in the hands of a private company until January 1, 1912. At present approximately 85% of

the telephone exchanges in Great Britain are open night and day. In fact, continuous service is now the general rule at all British exchanges where there are as many as 20 subscribers. This provision is distinctly in advance of the announced German policy, which contemplates the maintenance of continuous operation at central offices having more than 1,000 main stations. In Sweden, also, central offices with less than 500 subscribers are generally closed at night, although extended service may be given, if the subscribers guarantee a certain revenue from the extra fees imposed for telephoning after 9 P.M.

Sunday and Holiday Closing

In addition to shutting down for the night, it is quite customary for the less important telephone central offices abroad to remain closed on Sundays and holidays, except for a couple of hours. Thus, the smaller central offices in Germany and in Norway, for example, are open only for two hours on Sundays and holidays; and in Belgium and other Continental countries similar restrictions prevail to a greater or less degree. In France 95% of the telephone exchanges are closed on Sundays and holidays except between 8 and 11 A.M.; and a few years ago a French periodical suggested in all seriousness that the Minister of Posts, Telegraphs and Telephones might well "prove his humanitarian sentiments" by making the telephone employees a New Year's gift of an absolute Sunday closing of all exchanges in France.

In Great Britain, however, reduced hours of service on Sundays (and on Good Friday and Christmas) are in effect at only about 16% of the total telephone exchanges; and very few central offices are closed altogether on Sunday. In marked contrast to this condition is the situation in New Zealand, where on Sundays and holidays approximately two-thirds of the telephone exchanges are closed all day, and nearly half of the remainder are open for only a couple of hours.

"Luncheon Intervals"

In addition to being cut off from telephone communication at night and for the greater part of the day on Sundays and holidays, many telephone users in foreign countries are deprived of service at certain other times as well.

In New Zealand, for example, about 7% of the central offices suspend operations for a "luncheon interval" of from 30 minutes to an hour, or for a like period in the early evening, during the whole or a part of the year. On the Continent of Europe the midday closing of small telephone exchanges is common practice. The Norwegian government telephone system, for example, regularly suspends service at offices in the rural sections from 1 to 4 P.M. every week-day; and in Germany, also, about 93% of the telephone exchanges are closed for two hours at midday. Central offices in the country districts of Germany—the so-called "Auxiliary Post-Offices"—have no fixed hours of service, the manager simply being on duty, as a rule, during the entire day.

As recently as last July, 93% of the telephone exchanges of France were regularly closing from noon to 2 P.M.,—presumably while the operators had their lunch, although two hours seems a rather generous period to allow for luncheon, especially when it involves discontinuing the service during that time. Announcement was made, however, early in August that thereafter telephone service would be given between 12 and 2 at all French telephone offices having over 25 subscribers; but no information is at hand as to the percentage of the total French exchanges affected by this concession.

Of course, the machine-switching, or automatic, system of telephone operation affords a means for providing continuous service, so far as local calls are concerned, because it enables the subscriber to make his own connections. This, in fact, has been urged in Germany and in some other countries as one of the principal considerations in favor of the introduction of

machine-switching at small exchanges. It should not be overlooked, however, that the "continuous service" thus afforded is merely a continuous local service, unless a toll operator is accessible to handle toll calls,—an arrangement apparently not generally contemplated by those who, in various countries, are urging the introduction of machine-switching as a means of providing continuous operation of rural exchanges.

Sufficient instances have been cited to illustrate the fact that, except in the principal urban communities, the service rendered by the telephone systems in foreign countries is generally not a continuous service. Outside the larger cities, suspension of telephone service at night, during the greater part of the day on Sundays and holidays, and in many cases during a lunch hour even on week-days, is the rule rather than the exception.

Extra Charges for Night Service

It must not be assumed, however, that the telephone subscriber is, in every instance, precluded from making special arrangements to obtain telephone service during the periods when operations are suspended at the exchange with which his telephone is connected. In most countries special arrangements for such "extra" service may be made, but in such cases additional charges, over and above the regular telephone rates, are imposed. The number of subscribers in any one exchange who can avail themselves of these extra facilities is, moreover, limited by the number of trunk lines leading from the central office; and such special service is generally hedged about by official restrictions and conditions of one kind or another.

Thus in most countries fixed connection may be established between two subscribers of a local exchange during the hours when it is closed, or a subscriber may have his line connected through, at such times, to an exchange where continuous service is maintained, provided the necessary trunk lines are available and "the

exigencies of the service permit." The charges for nightly connection with another exchange vary in different countries from about $4.50 to $31 per annum in addition to the regular rates. Ordinarily the subscriber must not only pay the extra rate, but must also subscribe for the special night service in advance for a definite period, say a month or a year.

Emergency Calls

What then of the telephone user confronted by a sudden emergency at a time when his exchange is officially closed? In certain countries such an individual may, if he uses due diligence and is blest with a modicum of luck, accomplish something even after ordinary telephone service has been discontinued for the night.

In Italy, for example, emergency private calls may be put through after hours even at those interurban telephone offices in which the service from midnight to 7 A.M. is ordinarily limited to State correspondence and service calls.

So also in Australia and New Zealand telephone central offices may be kept open or reopened for the transmission of calls after business hours, if notice is given in advance, or if the attention of the offices concerned can be gained. In either case special fees are charged for this service, and in Australia the availability of such facilities at the small "Allowance Post-Offices" is made contingent on the Postmaster's being "willing to give the necessary attendance."

"Cut Off After 8 P.M."

Even in England the difficulty of telephoning late at night has given rise to considerable complaint. As recently as last September a London paper remarked that "many of the smaller country towns are virtually cut off from all communication with other places after 8 P.M.," and quoted a letter describing the difficulties

encountered in putting through, shortly after midnight, an important telephone call for London from a town about 40 miles away. The would-be telephone user, it seems, went to the head Post Office, and after banging on the door with his fists succeeded in attracting the attention of one of the men on duty. Poignantly his letter described how he was informed that it was impossible for him to telephone from the Post Office, although if he liked he could "knock up" a private resident who had a telephone. Only after much haggling, the writer declared, did the attendant consent to put through the call.

"Disturbance Fees"

Recently, however, the British Post Office has been trying to arrange, where possible, that rural districts shall not be isolated at night because of closed telephone exchanges. The plan, as outlined in the press, contemplates that, where operators live at the exchanges, a special "disturbance fee" of one shilling shall be allowed them for calls put through after hours. In this connection a Post Office official was quoted as saying that the instructions against the use of the telephone after office hours were intended to apply only to ordinary calls, and that, in cases of illness or other emergencies, there is no objection to men on duty putting calls through at night.

Scarcity of Public Telephones

Even in British cities where the telephone service is in continuous operation, however, its usefulness is considerably restricted by the scarcity of public telephones. Public pay stations in Great Britain are, for the most part, installed in shops, and are therefore not accessible after ordinary business hours. A letter published a year or two ago in a London paper told a pathetic story of the writer's frantic search through the dim and empty streets for a public telephone from which to call a physician to her mother, taken suddenly ill and perforce

left alone while the daughter ran out to summon aid. The search for a telephone was unsuccessful; but at last a passing taxicab driver took the girl's message for her.

Of late the British Post Office has been increasing the number of public telephone "kiosks," or booths, in London, Liverpool and other cities. In certain cases, however, difficulty has been experienced in securing the necessary permission from the local authorities; and in many localities the number thus far erected seems to be quite inadequate. A newspaper in the important commercial city of Manchester, for example, complained only a few months ago that, although seven public telephone kiosks had been installed, it was practically impossible to obtain the use of a telephone late in the evening, either in the center of the city or in the suburbs.

A Concession to Private Enterprise

In other European countries, also, public telephones are decidedly scarce. Within the past year, however, the French postal authorities have granted a franchise to a private company for the operation of coin-box telephone pay-stations throughout France,—a significant concession to private enterprise in a country where the telephone service has been a government monopoly since 1889. The type of coin-box which this company proposes to install will provide, after the American fashion, for the return of the user's money in case a call is not effective.

The lack of such a device in British coin-box telephones was recently criticized by a London paper, which remarked that "coin-boxes have been devised and for many years operated by the Bell Telephone Company which enable the operator to return the money if the call proves abortive." However, a recent issue of an English technical journal states that "the Post Office is experimenting with new apparatus to enable people to use the ordinary call-boxes for long-distance telephony," adding that "the box is designed to take silver as well

as copper coins, so that almost any trunk call can be made from an ordinary call-box," and that "if the call is not effective, pressure of a button returns the money."

No Person-to-Person Service

This is not by any means the only convenient element of telephone service well known in the United States but signally lacking abroad. Englishmen, for example, have been complaining rather frequently of late because the British Post Office does not offer a person-to-person service on long-distance telephone calls, but exacts payment if connection is established with the distant telephone, whether the particular person desired is accessible or not. So, too, under the Australian telephone regulations, although all reasonable efforts will be made to obtain the attendance of a particular person, a small fee for this service, and the toll charges incurred as well, must be paid irrespective of the success or failure of the attempt to obtain the required individual.

Waiting Lists for Long-Distance Calls

As a rule, also, long-distance telephone conversations abroad are strictly limited in duration. If there are other calls awaiting the use of any circuit, a connection over the circuit may be arbitrarily discontinued at the expiration of a fixed period, usually five or six minutes, whether the conversation has been completed or not. In many countries the number of long-distance telephone lines is so inadequate that calls have to be "booked" on a waiting-list, and it is often several hours before the party booking a call is informed that he is "through,"—in other words, connected with the number called. In fact, press reports of a few years back indicate that, in at least one important country on the Continent, enterprising speculators built up a lucrative trade by booking calls to important points every morning, and then selling their advantageous places on the waiting lists to persons

whose business would not brook the delay entailed in awaiting their turns.

"Urgent" Calls at "Urgent" Rates

In many foreign telephone systems provision is made for the expediting of long-distance telephone calls upon the payment of an "urgent" rate largely in excess of the regular toll rate. Where an "urgent" or "lightning" service is given, it affords the nearest approach to the American standard of long-distance telephone service on practically a no-delay basis. Even when the high "urgent" rate is paid, however, the European telephone user does not have available a long-distance service really equivalent to that in this country, for in Europe conversation is not possible at any price over such distances as are covered by the transcontinental telephone circuits in the United States.

In Germany and some other countries the "urgent" rate is triple the ordinary long-distance telephone rate; in New Zealand, Sweden and elsewhere it is double the base rate. Some years ago, however, Sweden introduced a so-called "lightning" service, which gives precedence even over "urgent" calls; and for this the charge was fixed at triple the ordinary rate, plus 100 kronor (about $26) for three minutes' conversation. "Urgent" service is not offered by the British or Australian telephone systems.

Some Rules and Regulations

Another practice which prevails in many foreign telephone services is the requirement that rates for exchange service be paid for three to six months in advance. In Great Britain the subscriber is required to make a deposit in advance against future toll charges. Should he desire a monthly itemized bill of the charges against his account, he must, both in Australia and in Great Britain, pay an additional fee for such a state-

ment,—a requirement which has been the subject of considerable adverse comment in the British press. Moreover, the accuracy of British telephone bills, duly certified, may not be successfully disputed by the subscriber. A clause in the British telephone contract provides that a certificate under the hand of the appropriate officer of the Post Office "shall be conclusive evidence of the matters certified"; and the subscriber is therefore precluded from successfully challenging the correctness of the Post Office account of local and toll calls charged against his telephone. This has given rise to some rather acrid controversies, particularly in cases where the subscriber has contended that the telephone was shut up in an empty house, inaccessible to anyone, except perhaps burglars, during a period for which calls were charged.

In the matter of liability for damages, too, the position of the telephone subscriber abroad, who is compelled to deal with a government department, is, generally speaking, distinctly less favorable that that of the American subscriber, who gets his telephone service from a private corporation. In various countries the subscriber is held strictly accountable for damage to his telephone apparatus, even in the absence of negligence on his part; while, on the other hand, governments are prone to disclaim liability for damages arising from telephone operations, even in cases in which a telephone corporation would, in this country, be held responsible.

"Telephone Service" Abroad

While it is difficult to generalize as to a service of such diverse characteristics as telephone service in foreign countries, certain features stand out as of fairly common occurrence.

Outside of the more important cities, the service afforded by foreign telephone systems is seldom a continuous day-and-night service, on week-days, holidays and Sundays, such as is given as a matter of course in

the United States. Subscribers desiring continuous service may, to be sure, obtain it by special arrangements, if the exigencies of the service permit, but only on payment of an extra rate. The usefulness of the telephone in emergencies is seriously restricted in many countries, not only by the limited hours of service, but also by the paucity of readily accessible public telephones.

The inadequacy of telephone toll circuits, which gives rise to waiting-lists for long-distance calls, the charging for "urgent" messages of double or triple the ordinary rate, and the general lack of provision for person-to-person calls, are a few of the elements which sharply differentiate most foreign telephone services from that in the United States.

Moreover, in certain countries telephone users are subjected to practices which an American would regard as decidedly irritating, such as requiring a deposit against future toll calls, charging for a monthly itemized bill, and imposing upon the subscriber a distinctly less favorable legal position in relation to his telephone contract than he would enjoy were he dealing with a private company.

"Telephone Service" at Home

"Telephone service" in the United States means continuous service, with all long-distance connections on as nearly as possible a no-delay basis, with a person-to-person service on long-distance calls, and with the legal and commercial relations between the telephone company and the subscriber on a basis even more favorable to the latter than in ordinary mercantile transactions. In most foreign countries "telephone service" means something very different.

Richard Storrs Coe.

Note: Mr. Coe is of the staff of the Chief Statistician of the American Telephone and Telegraph Company.—*Editor.*

Population Estimating

TELEPHONE service is now so intimately connected with the business and social life of the United States that there is a more or less definite relation between growth in the business of the telephone companies and growth in population. Consequently, it is a function of prudent telephone management to estimate population increases as accurately as possible in advance, in order that facilities may be ready when required, but without losses due to improperly located or overbuilt plant.

In forecasting the requirements of the future, each of the operating units of the Bell System makes population estimates from time to time for its various exchanges. To assist the operating companies in their estimating work the central organization makes forecasts of the future gains in population for the whole United States and its major territorial units. This central organization also endeavors to keep informed with respect to influences tending to affect increases in population, and to develop methods of making population estimates.

Any estimate of future population, of course, may be greatly in error because of the occurrence of some unpredictable event. No one, one hundred years ago, for example, could have foreseen the effects of the railroads on the settlement of the West, nor could the social and economic influences of the telephone have been predicted a half century ago. The redistribution of population brought about by the automobile and good roads would probably have been overlooked in an estimate made even twenty years ago, while changes in the status of communities caused by the World War were perhaps unpredictable even a decade ago.

Events which could not have been foreseen, however, have been much less numerous in the past than those which could have been expected by any one with adequate information, and there is no reason for believing that

the future will differ materially in this respect. Even when such events have happened, comparatively few cities or towns have had the direction of their growth materially altered. Most communities are thus growing because of factors which can be foreseen and analyzed, and consequently estimates based on complete data and scientific reasoning will probably fall within the permissible margins of error much more frequently than will guesses unsupported by such evidence.

Within the Bell System, population estimates must be made for a wide variety of communities which differ in the causes of their growth and in the adequacy of the data available as to past history. Naturally the engineers must adjust their methods to these varying conditions. In spite of differences in conditions, however, there are a number of considerations of wide application, which are of importance in estimating future population.

No comprehensive estimate can be made for any community without considering many other communities. Modern cities are not surrounded by Chinese walls which keep their inhabitants from moving away, and outsiders from entering. On the contrary, the ease with which people can abandon one locality for another makes the growth of any community dependent on the growth of all other communities within the nation. Consequently nation-wide studies of population are properly the basis for estimates for particular communities.

Effect of Immigration on Population

It is evident that the United States can gain in population only if more people are born than die, or if there are more immigrants than emigrants. During the decade from 1910 to 1920, net immigration added 2,700,000 inhabitants to the United States, while the number of births exceeded the number of deaths by nearly 11,000,-

000. During the previous decade the natural increase was less than 10,000,000 while the net immigration exceeded 6,000,000. Perhaps an economist would tell us that birth rates would go up if immigration fell off permanently, or immigration would decline if the increase in population from natural causes were large. Such interdependence of the two sources of population gains are possibly true over long periods of time, but the adjustments are so slow that the natural increase and net immigration have to be estimated largely independently of each other in forecasts for two or three decades, which is as far as the telephone engineer ordinarily goes.

A few years ago, an estimate of immigration to the United States would have been extremely difficult as the number of immigrants depended largely on the number who wanted to come, which would have been a very hard thing to gauge unless European conditions were intimately known. Now, however, we have a law which allows fewer foreigners to come to our shores than wish to settle here. This law continues only to the middle of 1924, but Congressional sentiment appears to favor at least as severe restrictions beyond that date. If this is the case, net increase in population due to the excess of immigration over emigration in the future will probably not exceed 3,000,000 per decade, which is at a lower rate than at any time since the Civil War.

Birth and Death Rates

The next question is whether declining immigration will be balanced by a larger excess of births over deaths. The answer to this question is complex because it involves both future birth rates and future death rates.

It might be argued here that an individual now has a better chance to live than an individual of the same age a decade ago, because with the advances in science and the medical arts, preventative medicine and sanitary

engineering are banishing many of the former plagues of mankind and more people are following the laws of health. All this is probably true, and in an estimate of the future, allowance must be made for further improvement, but it must also be remembered that the average age of the population of the United States is greater than it was a decade ago, so the total death rate may show little reduction.

The rate of natural increase in population depends on birth rates just as much as it does on death rates. Birth rates depend upon a variety of factors, such as the relative proportion of the sexes, the age distribution of the population and its economic status, marriage rates, and current social ideas. The possible births in the United States are limited by the number of females of child-bearing age, which for statistical purposes can be reckoned as between 15 and 44 years. However, many of these women never marry, and most of them remain single several years after they have passed their fifteenth birthday. In making a comprehensive estimate for the future it is thus necessary to consider the factors influencing the age of marriage.

Foreign-born mothers or those low in the economic scale tend to have more children than those of middle-class American stock, and as immigration declines and the general economic well-being of the country improves, we may expect some tendency for birth rates to decline. Then there is "race-suicide." If children are not as welcome as they used to be, what effect will that have on future birth rates? If we have relatively fewer children in the future, how much will this be compensated for if we let fewer of them die in infancy?

Mid-Century Population of the United States

The future population of the United States will be the resultant of all these various forces. If present

tendencies continue, or if the changes in tendency are all in the direction which now seems probable, the natural increase during the next two or three decades will be slightly larger numerically than it was during the last decade, but smaller on a percentage basis. The mid-century population of the United States may be expected to be somewhere between 150,000,000 and 155,000,000, the exact figure depending in a large measure on Congressional attitude toward immigration. Such a population in 1950 represents a rate of increase considerably below any previously experienced by the United States.

A population of 150,000,000 to 155,000,000 will require a greater amount of food and clothing than does the present population of the United States. It will also need more lumber, iron, and other materials from which human habitations and means of transportation can be built. Enough of the prospective increase in population will have to go to the farms, the mines, and the lumber camps to produce the necessary raw materials to meet the national needs for their products. It is essential, therefore, to picture the requirements of the basic rural industries, before it is possible to say what growth can be expected in all the cities and towns of the United States, or in any particular urban community.

Rural Population

The considerations involved in forecasting future rural population are varied. More food can be raised if more land is farmed, or if land now in use is cultivated more intensively. Also we can cease to export foodstuffs. Power machinery can be substituted for hand labor, better varieties of crops can be raised, breeds of cattle can be improved, and by the use of fertilizers and scientific methods the yields per acre can be increased. Some of these things which will undoubtedly have to be done as the population of the nation increases may necessitate a considerable increase in farm population, although it is conceivable that improvements in agricultural meth-

ods might be carried so far that the country would not need as large a farm population as it has today. It is more likely, however, that actual conditions will be somewhere between these two extremes, so that there will be a moderate growth in farm population, but differently distributed throughout the country than it has been in the immediate past. It is also probable that the resources of Canada and South America will become increasingly available.

In the population studies of the Bell System, similar analyses have been made of the prospects of the mining and lumbering industries, and on the basis of these analyses it has been estimated that the rural population of the country may increase between 6,000,000 and 7,000,000 before 1950, or at a considerably lower rate than that of the past. This leaves a growth for the cities of the United States of 38,000,000 to 42,000,000 for the next thirty years, distributed among the urban communities of the nation. In a real sense, then, the growth of Boston, for example, is affected by conditions in the mines of Michigan, the forests of Washington, and the plantations of Mississippi.

Population Estimates for Cities

In most telephone problems, it is not sufficient to have an idea of the rate of growth of the nation only, but there must be a fairly accurate estimate for a particular community. The question naturally arises as to the part a given city will take in the general urban growth, or more broadly as to the factors which determine why one city will grow rather than another.

Just as is the case of the whole United States, the growth of any city depends on the excess of births over deaths, and the excess of arrivals over departures. The rate of natural increase for a city depends on the same factors as does the natural increase of the nation as a whole. As city populations are now constituted, this

would average about 10% or 12% per decade, or, in other words, if no one moved either in or out of the cities of the country, they would have in 1950 approximately 19,000,000 more inhabitants than they have now. Each individual city may be pictured as in conflict with all others to hold its own share of this natural increase and to acquire as many as possible of the 19,000,000 to 23,000,000 who will come from foreign shores or the rural districts, or who will be the descendants of such migrants. The real question, then, is what advantages has any particular city to attract people away from all the others?

Men move to a city either because they like it, or because they can earn a living, or in some cases because they have little choice in the matter. The latter class includes those who are committed to jails or asylums, those who are sent to schools or colleges, and those whose physical condition forces them to seek the city's hospitals. All such institutions affect the growth of a city, but their original location there or the territory assigned to them may have been the result of legislative caprice.

A much larger number of people go to a particular city because they think they will like it. This class includes the independently wealthy, the retired, the adventurers, and all those who choose a place to live first, and then adjust their occupations, if they have any, to what is available there. The features of a city which attract these classes are varied in character; one city, for example, has its climate; another its seashore attractions; one has cultural and historic interests; while others have social advantages, and a variety of attractions ranging from amusement parks to speculative markets.

Good Jobs Attract Population

The vast majority of migrants probably go to the place where they think they can get good jobs. The

cities which are able to attract migrants are thus largely those where there is a demand for labor, and such demands for labor are due usually either to industrial expansion, the development of tributary territory, or growth of governmental institutions as in Washington. In estimating the future population of any city, therefore, all these points must be carefully considered. For example, it is necessary to determine at least roughly the size of the retail and wholesale trade territories of the city, the probable future prosperity of those territories, and the extent to which the city under consideration will gain or lose tributary territory in its competition with other cities. The availability of industrial sites, transportation facilities, special advantages for particular industries, and reputation of the city as a manufacturing center must also be considered.

While the consideration of these influences will not eliminate all the possibilities of error in a population estimate, they undoubtedly result in more accurate predictions than would be possible upon the basis of guesses. Work that has been done along these lines in the past has enabled the telephone companies to proceed with the extension of their properties with confidence that the business is being developed along basically sound lines, and with a maximum of economy. This work has been of benefit not only to the telephone companies, but also to the public.

FRED H. STERNS.

NOTE: Dr. Sterns is of the staff of the Commercial Engineer of the American Telephone and Telegraph Company.—*Editor.*

Cable Development and Research

From an Address at the Annual Meeting of the Telephone Pioneers of America, in Atlantic City, N. J., October 19, 1923

ALTHOUGH this assemblage of the Telephone Pioneers of America provides abundant evidence that we are living in the present, we may, perhaps, be pardoned for exercising the privilege of pioneers and drawing on the past for inspiration, even to the extent of going back centuries beyond the days of the telephone itself. To obtain a phrase around which to centre our thoughts, while discussing Cable Development and Research, let us borrow from Virgil some words which he puts into the mouth of his hero, Æneas.

Æneas was himself a pioneer. Driven from the city of his birth by enemies, he faced hardships without number, meeting danger and discouragement at every turn, and at last coming to Italy where, tradition says, he became the father of the Roman race. Recounting the story of his sufferings and sorrows, the Latin poet pictures him as using these striking words: "which . . . things I myself have seen and of which I have been an important part."

The history of the telephone has had its baffling obstacles but it is also replete with its achievements. It has had its discouragements but these sink into insignificance in comparison with its glorious triumphs. One of our privileges as Pioneers, is to look back upon these years of struggle and accomplishment with the thought that we ourselves have seen these things and of them, directly or indirectly, we have been a part.

It is inspiring to look back upon the marvelous growth of the telephone not merely as an industry but as a great instrumentality of national service. More inspiring still is it to feel that in this remarkable growth each of us has had a share. It has not been the achieve-

PAPER ~ INSULATED CABLE, ACTUAL SIZE

1888
100 WIRES, No. 18 B&S. GA.

1914
2424 WIRES, No. 24 B&S. GA.

ment of any one man or group of men. It has, in truth, been the result of team play; of the coordinated efforts of a multitude of workers. And this applies to the branch of telephone work that we are to discuss today as well as to all others. While it may seem to the man or woman in the field that his or her work has been far removed from Development and Research, as a matter of fact the two activities are closely related.

Field Work as Related to Research

Many of the problems that Development and Research seek to solve, arise in the field and it is the duty of Development and Research to anticipate conditions of growth and the new requirements brought about thereby, sufficiently in advance so as to develop and have ready for service in the field, thoroughly tried-out materials, apparatus and methods when these are required so that the orderly expansion of the business will not be choked. No matter how carefully and conscientiously this work may be done, the results of years of labor might be brought to naught if the men in the field who install, or maintain, or operate these things do not perform their portion of the work just as carefully and conscientiously. But the men and women in the field have never failed to do exactly this! It is to the everlasting honor of the telephone art that, in assuming responsibility and in sharing credit, its thousands of men and women have never drawn a line between one kind of telephone worker and another. Each, in his own way, has done his share toward making this extraordinary growth possible and each may now look back upon it with pride and say, with Æneas of old, "of these things I have been a part."

Let us see what this growth has been. Twenty-one years ago, the youngest Pioneer began the service which has qualified him for membership. What has happened in these twenty-one years? Twenty-one years ago—in 1902—the number of stations owned by the Bell System, or with which it was capable of connecting, had passed

the million mark. That total, as you all know, now exceeds 14,000,000. The number of local, toll and long distance conversations held daily was then about 9,500,000; last year it was upwards of 38,000,000. The total wire mileage of the Bell System was then about 3,250,000; now it is about 31,000,000. The total miles of wire in underground cable were then about one and one-third million; today this figure has become about twenty million.

Typical Telephone Development

Within the time allotted us here it is obviously impossible to take up more than a single one of the multitude of features of telephone development work any one of which would disclose facts just as interesting and significant as those afforded by the subject of cables. For the purpose of this talk cable development and research must stand as typical of the many other branches of development and research work in showing the relation between scientific investigation and the improvement of the art, the growth of the industry and the increase in its usefulness to the people of the Nation.

A few moments ago we spoke of going back to 1902, the first year of service of the most recently qualified member of the Pioneers. That year just about cuts the history of our cable development into two equal parts, for the real history of cable development is about forty-two years old, the first serious attempts on any extensive scale to solve the problem of getting rid of open wires having begun shortly before 1880.

Some time before this, the use of cables had been foreseen as a possibility. Dr. Bell, himself, the first Pioneer, as early as 1878 made a prediction which was strikingly prophetic. In a letter addressed to a group of gentlemen in London he said: "It is conceivable that cables of telephone wires could be laid underground, or suspended overhead, communicating by branch wires with private dwellings, country houses, shops, manu-

factories, etc., uniting them all through the main cable with a central office where the wires could be connected as desired, establishing direct communication between any two places in the city."

The use of cables, as a substitute for open wires, in order to reduce the congestion in thickly populated cities, was not, however, the first phase of their development. The principal earliest use of cables for telephonic purposes was where it became necessary to carry groups of wires across navigable rivers, either by placing them on bridges, or in tunnels, or allowing them to rest on the bed of the stream.

Pioneer Cable Experiments

It is not unnatural, therefore, that one of the earliest records of the use of cables indicates that they were placed on the Brooklyn Bridge, across the East River, as early as 1879. Mr. C. E. Chinnock, electrician of the Metropolitan Telephone and Telegraph Company, speaking in September, 1880, said: "We have over the East River Bridge, at the present time, four cables, 3,800 feet long, each cable with seven conductors. These cables have taken the place of cables that were previously there with the ordinary Kerite insulation and gutta-percha. In using the cables and talking on one wire you could hear whatever was said on another wire, and by wrapping each conductor with lead and grounding at intervals, all of the escape and all induction were completely eliminated. These cables have been in use, two of them for six months and one for nine months and are working perfectly."

This was, of course, the era of single wire, grounded lines. General Carty's early work in applying the metallic circuit principle to the Boston-Providence line had yet to be done. It is interesting to note that although the Brooklyn Bridge (the building of which had begun some ten years before), had not yet been formally opened for traffic, it became an indirect means of communica-

tion before it was ready for the direct communication purposes for which it was chiefly intended.

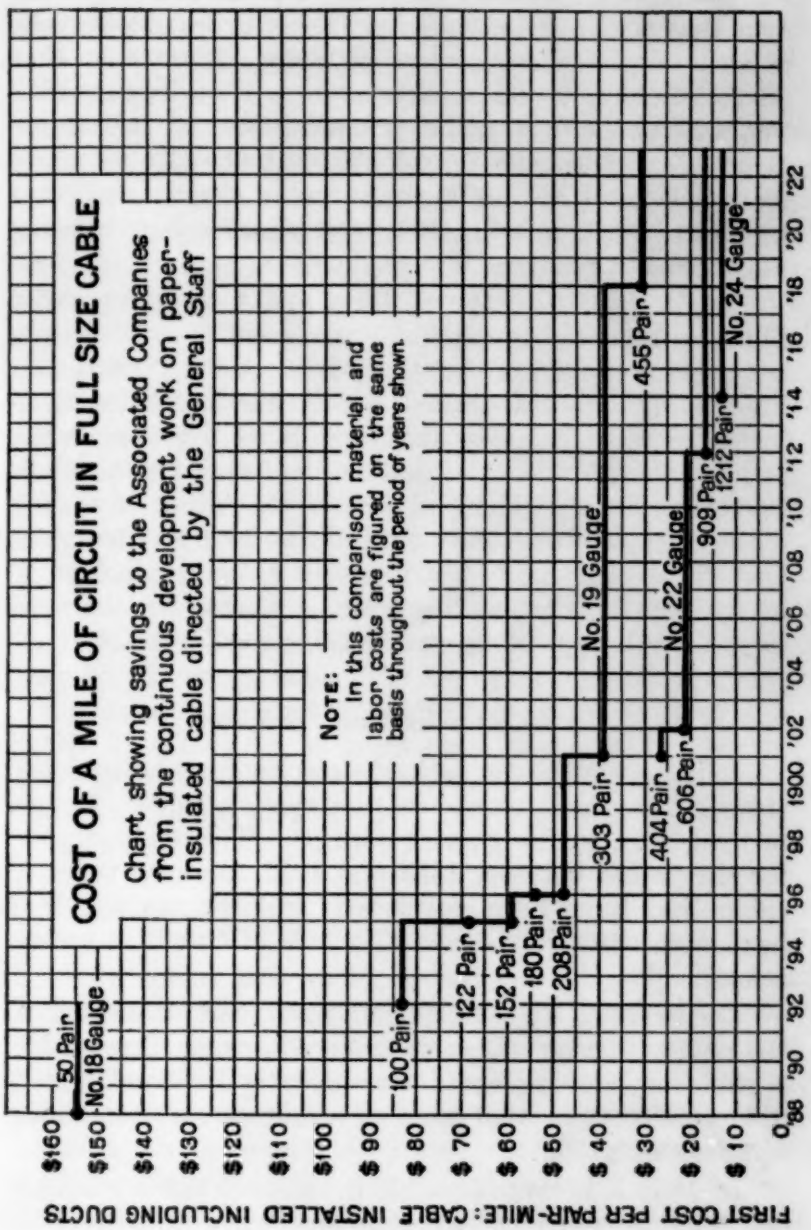
During the first decade of cable development, many different types of construction were employed. At first, the infant telephone art turned to the older telegraph art and availed itself of rubber and gutta-percha which had long been used as insulating materials in telegraph cables. But rubber and gutta-percha, although well suited for telegraphic purposes, caused the telephone to work very badly, so that the voices of one's friends were frequently almost unrecognizable, the sounds being muffled and hollow and seeming to come up out of the earth.

For a time oil insulation was employed to a considerable extent, and, in one cable, at least, each one of about 20 wires was enclosed in a glass tube surrounded by grease and rosin. Then came cotton covered wires having the cotton impregnated with paraffin. But the progress was slow as will be seen from the fact that in 1885, the total wire mileage underground in New York City, where it naturally was needed most, was about the same as would be contained in a quarter-mile length of our modern 1,200 pair cable.

An Early Cable "Creed"

W. R. Patterson, of the Western Electric Company, was famous as a telephone cable engineer at that time. Writing in 1885, on the underground problem, he said:

"In conclusion, to state our creed, we believe in both aerial and underground wires, without bigotry or intolerance toward either, and with due recognition of a suitable and proper field for the use of each. We do not have much faith in the man who says he can put 2,392 wires in a space 2⅞ by 3¼ inches, neither do we expect a lineman will be a necessary feature of every circus of the future, to show people how they used to climb poles in the old days of telephone wires."


COST OF A MILE OF CIRCUIT IN FULL SIZE CABLE
Chart showing savings to the Associated Companies from the continuous development work on paper-insulated cable directed by the General Staff
NOTE:
In this comparison material and labor costs are figured on the same basis throughout the period of years shown.
50 Pair
No. 18 Gauge
100 Pair
122 Pair
152 Pair
180 Pair
208 Pair
303 Pair
No. 19 Gauge
404 Pair
606 Pair
No. 22 Gauge
455 Pair
909 Pair
1212 Pair
No. 24 Gauge
FIRST COST PER PAIR-MILE: CABLE INSTALLED INCLUDING DUCTS
$160
$150
$140
$130
$120
$110
$100
$ 90
$ 80
$ 70
$ 60
$ 50
$ 40
$ 30
$ 20
$ 10
0
'88 '90 '92 '94 '96 '98 1900 '02 '04 '06 '08 '10 '12 '14 '16 '18 '20 '22
YEAR

We rejoice that Mr. Patterson's prediction has come true that the lineman, one of our finest types of associate, is still with us. And, were he living, I am sure that Mr. Patterson would rejoice with us that, twenty-nine years after he wrote the preceding words, it became possible to place, not only 2,392, but actually as many as 2,424 wires within a single cable sheath and that upwards of 400 miles of this type of cable is now being added to the plant each year.

Trials of omitting the oil filling and, later, the paraffin filling, culminated in experiments carried on with manila paper as a covering for the wires. To no particular invention can be attributed the transition from cotton-insulated filled cable to paper-insulated dry core cable. It was rather a matter of gradual evolution and accumulated experience. The omission of the filling or sealing material came about quite naturally as soon as experience had shown that lead sheaths could be so applied as to be trustworthy in excluding water. Thereafter, the need for an insulating filling compound ceased to exist.

Increased Savings in Cost

It is impossible, for lack of time, to describe in detail the steps in the evolution of the modern cable. Let us instead, turn to the chart before us. This chart shows, for the period between 1888 and 1922, the new types of cable that have been developed, and the savings that have been made in the cost of a mile of circuit in underground cable.

Up to 1892, the efforts put forth had succeeded in the ability to place 50 pairs of No. 18 gauge wires within a cable as large as could conveniently be handled. A mile of circuit in that kind of cable would cost today upwards of $150.

In 1892 it became possible to make cables containing one hundred pairs of No. 19 gauge wires and, by that improvement, the cost of a mile of circuit was nearly

cut in half. Continued developments brought further economies so that, with the arrival of the year 1896, the cost was brought below $50. This was cut to $40 by the 300 pair No. 19 gauge cable which became available in 1901. In 1918, came a further reduction to $30 with the advent of the 450 pair No. 19 gauge cable.

But activities were by no means confined to improving No. 19 gauge cables. In 1899, General Carty foresaw the rapidly approaching need for cables containing more pairs of wires than could possibly be obtained with conductors of No. 19 gauge. His well known prophetic vision stimulated development work leading to the production of cables with finer wires, and, as a result, the use was begun in 1901, of 400 pair No. 22 gauge cable, which was followed, the next year, by cables containing 600 pairs of No. 22 gauge. The 600 pair cable brought the cost per pair mile almost down to $20.

Ten years later, in 1912, came the 900 pair No. 22 gauge cable, bringing the cost well below $20. Then, in 1914, the fifteen dollar line was crossed by the 1,200 pair No. 24 gauge cable. Think of it! A mile of circuit for one-tenth of what it would have cost 30 years ago, when 24 cables, of 50 pairs each, would have been required to furnish the same number of circuits as are today available in a single 1,200 pair cable containing 2,424 wires!

A Concrete Illustration

Now let us look at an actual case in order that we may see the meaning of this increased number of pairs in our cables and the consequent decrease in cost per pair-mile. Not long ago the new Jefferson switchboard in Brooklyn was cut over. In all, thirty cables were placed: 18 twelve-hundred pair, 11 nine-hundred pair and one three-hundred pair. If that cut-over had been made only eleven years ago, no less than 54 cables would have been required, instead of thirty, to have provided

the same number of wires. If it had been made thirty years ago, with fifty pairs as the capacity of a single cable, it would have required 636 cables instead of thirty.

Looking again at the chart, let us see what trends we can discover. In recent years, the reduction in the cost per mile of circuit, resulting from each improvement, has been less than the reductions accomplished by the improvements of the earlier years. This does not mean that the total number of dollars saved by each of these later improvements has been less than the savings that were made back in the nineties. On the contrary, each of these later steps has saved many more dollars than were saved by any of the earlier improvements. The reason for this is because so much more cable is added to the plant each year than was the case twenty-five or thirty years ago. For example, the year 1892 witnessed 20,000 miles of wire added to the underground plant of the Bell System. That was a great gain for 1892, but 1922, thirty years later, saw 2,000,000 miles added—one hundred times as much as in 1892.

The vastly greater savings of recent years are due to the fact that the relatively smaller gains, multiplied one hundred times, greatly exceed the savings that were possible in those earlier years. And the end is not yet. We are hopeful that the future will witness 1,500 pair and, perhaps, 1,800 pair cables, utilizing even finer wires than those heretofore generally employed.

These savings, so far as the cables themselves are concerned, have been attained by the use of smaller and smaller wires and by improved processes of cable manufacture. The experts of the Western Electric Company have played a highly important part in perfecting the processes of manufacture and in devising improved cable making machinery and methods.

Many Bases for Improvements

But from a broader view, it has been improvements in many different pieces of apparatus and in circuits all

along the line that have rendered possible the use of these fine wires in ever increasing lengths without injurious effect on the loudness and clearness of transmission.

It would be interesting, if time permitted, to consider in detail the effect of some of these improvements on the development of cables and to call attention to the economies which they have brought about. The development of quadded cables, which permit the application of the phantom circuit principle to cable construction, is a story in itself. The use of quadded cables has already effected a saving of $10,000,000 in the first cost of the plant.

Due to the applications of loading coils to cables, the Bell System plant has cost $75,000,000 less than would have been the case had the same transmission efficiency been attained by means of larger wires in the cables.

As a result of the application of repeaters in connection with related advances in cable construction, a cable now stretches from New York to Cleveland and is fast making its way to Chicago.

Examples of what research work has meant both in promoting efficiency and in obtaining economies in the development of the modern telephone cable are almost without number. Let us take a final example. At one time the cable sheaths were composed of 97 per cent. lead and 3 per cent. tin. The tin was added in order to avoid fracture of the sheath from vibration, to increase the breaking strength and as a protection against corrosion of the sheath from chemical causes.

New Alloy Saves Millions

About 1907, research work was begun in order to discover a new alloy which would be less expensive and just as effective. Dozens of alloys were made and patiently tested both in the laboratory and in the field where full-sized cables were pulled in and out of ducts to check up

their wearing qualities and in many other ways. Finally, a combination of about 99 per cent. of lead alloyed with one per cent. of antimony was adopted. By means of this alloy, more than six million dollars has already been saved to the Bell System in the first cost of cables.

Now, what does all of this development and research work mean? It means many things, but most of all it means the increasing usefulness of the telephone to the American people. It means that cities which had just about reached the point of telephone saturation thirty years ago because of the congestion of overhead wires, have had their wires put underground and their capacity for telephone development thereby increased hundreds, even thousands, of times.

It means the long distance cable, linking cities and towns in the bonds of speech. It means that telephone service has not only become physically available for millions of new subscribers, but has become financially available for them as well. Every reduction in cost per circuit-mile shown on this chart, and every other similar reduction has accrued to the benefit of the subscriber. It has helped to put the telephone within reach, not only of his hand, but also of his pocketbook. It has helped to make the telephone an instrumentality of better understanding; a means of making millions of men neighbors; a servant of the nation which it has helped to transform into one vast community.

All of this wonderful development and growth we Pioneers have seen and of it we "have been a part." More growth must follow, for it is a growing Nation that we serve. In this growth we and the Pioneers who are to succeed us will share, for the growth of the future, like that of the past, must be a product of team-play and coordination. Finally, to paraphrase Æneas, to "be a part of" this growth is not only our responsibility as telephone workers, but also one of our high privileges as Pioneers.

F. L. Rhodes.

The American Telephone Historical Collection

THE American Telephone and Telegraph Company has started at its headquarters building, 195 Broadway, New York, an historical collection of pictures and papers of all kinds, letters, note-books, documents, to perpetuate the personalities and the records of the men who have done vital work in the development of the Telephone. It has officially been given the name of the American Telephone Historical Collection. It is as the other half of the Bell System Museum of instruments and apparatus at the Western Electric building. The two are intended to supplement each other, the Museum emphasizing the technical side, the consecutive development of the telephone equipment; and this new Collection emphasizing the human side, the collaborating sequence of men in the telephone organization.

The Two Historical Collections

For example, at the Bell System Museum may be seen models of the earliest experimental telephones of Alexander Graham Bell; transmitters and receivers of every stage and of every year; circuits, from the very wire that carried the first intelligible sentence from room to room at 5 Exeter Place, Boston, to sections of the Havana submarine telephone cable; switchboards and innumerable details of switchboards from the hopelessly miscellaneous devices of the early days to the multiple, common battery switchboard of the present; loading coils and repeaters, showing additions and improvements until they made possible the Transcontinental Line between New York and Boston and San Francisco; and the 1/100 watt vacuum tube until it became the latest 100 kilowatt audion of today; — all displayed in clear, progressive order in the cases of the Museum, the whole

development of the Telephone equipment. But the men who did all this? That is another story.

The story of the men belongs to the American Telephone Historical Collection. There, at 195 Broadway, may be seen, for example, the original Bell Telephone Patent of March 7, 1876, No. 174,465 itself, "the declaration of independence of human communication" as it has been called; checks and receipts showing payments by Thomas Sanders to Alexander Graham Bell in 1875 for the expenses of his experiments; Thomas A. Watson's note-book of 1876, in which he entered that same evening the first intelligible sentence ever spoken over the telephone, "Mr. Watson, come here; I want you"; two of the first telephone stock certificates, issued by Gardiner G. Hubbard, Trustee, on August 1, 1877; the visitors' book signed by many people prominent in English aristocracy, science, and literature, who saw and used "Bell's Telephone" in London during the winter of 1877 and 1878; and Theodore N. Vail's letter of May 22, 1878, accepting the general managership of the Bell Telephone Company, although told that payment of his salary could not be guaranteed, and (now become how humorous!) "only asking in addition a reasonable assurance of permanency." Such were the men who did it. That is the story to be told in the new Collection.

Gathering Historical Material

The first work of the Historical Collection is the gathering of material. Down to the last detail everything is carefully planned to facilitate the gathering of historical material, to preserve and display it in such a way as to make clear its significance, and to ensure its safety and accessibility from the day of its receipt. The Collection occupies a large room on the 26th floor of the Telephone and Telegraph Building. The walls of the room are divided into panels, every Company in the Bell System having its own space. There, grouped under the framed name of the Company, hang portraits

of men who were important in the development of that Company. Every Company also has, under its group of pictures, a display case, in which the more interesting and valuable papers and articles relating to the Company can be kept on exhibition. Much the larger part of the historical material consists of letters, circulars and memoranda. These loose papers are taken care of in binders, specially made to suit the needs of this Collection, so that they may last not merely ten years or twenty-five, but hundreds of years.

The contributions to the Collection are coming in from many sources. The archives of the American Telephone and Telegraph Company are supplying much. The Bell System Museum at the Western Electric building has turned over to its partner the papers and documents it had gathered during the last ten years. Individual telephone men and women all over the country, voluntarily acting as collectors for it, are sending in single photographs, letters and papers of great interest and value. Mr. Thomas A. Watson has given all his papers of every kind in any way connected with the Telephone, leading the way in a course which is already being followed by others. The families of a number of telephone pioneers who have died are going through the papers of the estates to see if there are not some that they might properly give to the American Telephone and Telegraph Company for this Collection. All seem to realize the attitude of the Company in requesting or rather in welcoming such contributions, and to feel that they are not parting with papers for which the families have associations of sentiment stronger than anyone else could have, but that the Company is receiving these papers very much as a Trustee, to preserve them with expert care in fire-proof quarters permanently.

Here these papers will always be accessible to members of the family and to friends for inspection. Here they will so far as practicable be kept together in collections each under the name of the telephone man whose work

they represent. Here, thus gathered together in the same library with the papers and records of other telephone workers, in numbers increasing year by year, they will gain incomparably in value, from the standpoint of historical science, in a way and to an extent that would be impossible if kept, however safely, each collection by itself, scattered in various places over the country.

History in the Making

But the history of the Telephone is not a thing of the past. There is more Telephone history being made right now, and the Telephone is making more history for America right now than ever in the 1870's or 80's, or any other period of the past. There is also more danger of historical material being lost now than ever before, simply from the quantity of it, and from the increasing difficulty of judging right what will prove to be real historical material and what will not. One of the most important functions of this historical department of the Telephone will always be to gather and preserve complete and accurate records of every notable achievement of the Telephone at the time. Looking at it in the long view, this contemporaneous duty stands out as a prime function.

This brings up a distinction which has not heretofore been emphasized. The Engineering Departments of the Bell System of course keep complete and accurate records of every notable achievement of the Telephone as it occurs. But these are from the technical point of view,—*what* is done and *how* it is done. *Who* did it and what were the qualities of mind and character by which those particular men were fitted to coordinate their studies and their experiments and their efforts, overcoming all sorts of obstacles and impossibilities, until the triumphant result of the end achieved,—the record of these human elements, essential as they are to the end attained, have naturally not heretofore been recorded as systematically as now planned.

The Human Element in Telephone Work

Telephone men have always worked for the sake of the work and to accomplish the thing to be done, not for the sake of the reward or praise. Working all together, keeping even with the flood of work to be done, doing the work and doing it right, has been found by all alike, from the highest officer to the lowest employee, to bring at the end of the day a satisfaction that was entirely adequate in and by itself. That singularly clear record of devoted work, continuing now for almost fifty years, does not quickly fade into oblivion. It lies safe in the archives and files of the American Telephone and Telegraph and its Associated Companies. It shines in the memories of telephone men and women now living. It is still active in the work of the telephone forces of the present generation, who are continuing the record and steadily improving the service to meet the steadily increasing demands of American life.

That singularly clear record has had causes, and they were human causes. Those causes are to be found in the characters of the men,—one, two, three, four, and so on up to something like 335,000 men and women, counting only present employees,—who have made the Telephone and are still making it. That singularly clear record is a remarkable phenomenon. It is simply the natural common sense of good business and of good science to study that phenomenon and its causes. There is something of great value and importance to be found there.

To the telephone user the Telephone is an instrument. To the telephone worker and even more to the telephone engineer the Telephone is a system of plant and equipment. To the telephone administrator, and in the broad field of fact, it is at least equally true that the Telephone is an organization of men and women which is making immediate communication possible and is rendering a service which has already made neighbors

of a hundred million people and in due time will do the same for all the world.

The Human and the Technical Distinguished

It would be invidious to claim that this human element in the Telephone is more important than the technical. But it may be proper to call attention, in passing, to a fact which has significance though it is somewhat superficial: that the human is in its own form the more lasting element. To the worker, tired out by a lifetime of good work, it may seem that he is a temporary thing, but that, in proportion as it has been good, his work will last. Yet in fact the human factor is no more ephemeral than the technical achievements of the Telephone. Each invention, each improvement, is for its day a triumph of scientific imagination, of exhaustive thought, persistent experimenting, and of patient labor on the part of some engineer or group of engineers. For a while it is the latest and the best, then silently it gives way before a next achievement, another improvement, and in that particular form it is obsolete, a thing for the Museum, though the principle goes on, more valuable in newer improvements.

So too, the man may truly be said to continue. For example, the telephone instruments of Alexander Graham Bell are looked at now as the curious seeds of what came after, but the interest in Alexander Graham Bell himself is steadily increasing. The human problems of mankind will always continue to pour in upon men. The human qualities of mind and character that have met and overcome the great problems of social organization,—such as these problems of communication,—will always be valuable and engross the interest of the world. Men will always want to know about those who have done these things,—who they were, what they looked like, how they thought, what they said and did, and how they won their victory.

But, as said, it is invidious to separate a man and his work and then to make comparisons. A man and his work are really one. So too, an organization and the progress of its achievements. One cannot be studied properly, adequately, without the other. It is to gather up and put in systematic order this human material that the American Telephone Historical Collection has been started. With the gathering together of such material, all in one place, it becomes possible to make a proper start in the writing of Telephone History.

Two Aspects of Telephone History

Telephone History may be divided into two distinct parts, according to the aspect that is emphasized. One would present the part the Telephone has played in the development of America. Industrial history is only at the beginning of its possibilities. Only now is it becoming possible to write the history of the great industrial period into which comes the whole development of the Telephone. Only now is there any great industrial result to clarify the significance of what has been happening in the last 40 or 50 years. Only now are the industrial activities of the American people emerging from the turgid period of competition, after a period of strenuous struggle against the limitation of individual independence, into a period of unified service and industrial cooperation. The Telephone industry is the first to emerge. The Telephone industry is also the largest and the best example of unified service and industrial cooperation. In the story of its service to the development of the country, the Telephone offers a great subject for an important historical work.

But the Telephone is a practical organization, incorporated for certain definite ends and aims. History has a definite value to an industry like the Telephone far beyond the mere spare time interest of it. It is important, for practical daily work, that telephone people should understand those human causes of which we have

spoken as well as the physical causes of technical development. Science is the effort of men to understand the flood of physical causes in which we live, move, and have our being. History is the effort of men to understand the flood of human causes in which no less we live, move, and have our being. The object in both efforts is that men may the more intelligently, the more skillfully, the more successfully do their work. Herein lies the practical value of telephone history, just as of all history.

The Value of History to the Telephone

The primary cause in all things is character. In the development of the Telephone the greatest working cause has been the character of the individual men and women who have effected that development. The accumulated power of their characters is available to the present generation of telephone workers in the form of tradition. Tradition is the heritage of personality. Tradition enables the grandson to know the grandfather, not as an old man, but as an active force, a young man like himself. Tradition takes the pioneer and the young engineer both alike out of their pigeon-holes of ancestry and posterity and makes them companions in their work. Tradition has been a potent force in the fifty years' life of the Telephone and will be always. To formulate it, to make it easily recognizable and clear to young and old alike is what is desired.

To accomplish this for the active workers is the thing to be done in the writing of telephone history. To be successful, it must be brief in compass, vivid in delineation, correct in fact, true to character, and right in the interpretation of what was done. In so far as it is done right, it will hand down the past newly alive, as an evident cause, virile and young, for the moulding of the future. From records, from letters, from photographs, from papers, from sayings, from actions, computing the curve of this man's work, of that man's character, and of this or that group's collaboration, thence deducing their

personalities, weaving them together, more and more of them until there is seen rising again out of the past like a movie of forgotten days the living picture of the Bell System as it grew up from the beginning to the present,—this is the work for the Historical Collection to do. Thereby the telephone men of the past shall live again in a very true sense for those of the present who never saw them, and more and more their work will be an inspiration to their successors.

Heretofore, the Telephone, like most other industries, has to some extent allowed the inestimable forces of personality, experience and wisdom accumulated by its men during their lives, to escape and be lost with their death, like the white steam from the engine, that quickly vanishes in the air. The American Telephone Historical Collection is the beginning of an effort to conserve these human forces.

It looks forward to the systematic utilization of what we may call these more or less waste products. The greatest product the Telephone has turned out in its entire development is the spirit of service that dominates its workers from the highest officer to the lowest employee. This spirit of service is a human element. It is then entirely reasonable to hope that, much as the Telephone has done in its first fifty years, and tremendous as is its impulse for the future, it may accomplish still more by virtue of the food and inspiration for its spirit of service which the American Telephone Historical Collection as it grows will bring to the life of the Telephone.

WILLIAM CHAUNCY LANGDON.

NOTE: Mr. Langdon is of the staff of the Information Department of the American Telephone and Telegraph Company, in charge of the Historical Collection.—*Editor.*

Organization Changes

Ohio Bell Telephone Company

C. P. Cooper elected President:

Plant department, New York Telephone Company, 1908–1914; general plant superintendent, Chesapeake and Potomac Telephone Company, 1914; general plant superintendent, Cleveland Telephone Company, 1920; vice president and general manager, Ohio Bell Telephone Company, 1921.

R. Eide elected Vice President and General Manager:

Traffic Department, New York Telephone Company, 1911; supervisor of traffic at St. Louis, Bell Telephone Company of Missouri, 1913; supervisor of traffic, Michigan State Telephone Company, 1916; traffic superintendent for Ohio, Central Union Telephone Company, 1917; general traffic superintendent, Ohio Bell Telephone Company, 1921.

Pacific Telephone and Telegraph Company

D. P. Fullerton elected Vice President:

Western Electric Company, 1890; equipment department, Pacific States Telephone and Telegraph Company, 1897; general superintendent of plant, Pacific Telephone and Telegraph Company, 1913.

Abstracts of Recent Technical Papers from Bell System Sources

The Wetting of Glasses by Mercury,[1] by Earle E. Schumacher. The author attempted to cause mercury to wet glass and silica after their surfaces were denuded of gas as far as it was possible with present means. The difficulty of this task was found to become greater as the alkaline content of the glass increased. Fairly good wetting was generally obtained on quartz while on Pyrex and soda-lime glass it was obtained only occasionally.

The Scattering of Low Speed Electrons by Platinum and Magnesium,[2] by C. Davisson and C. H. Kunsman. This paper describes experiments in which electrons from a tungsten filament were accelerated with various voltages up to 1,000. A restricted beam of these electrons was directed against a platinum target at an angle of 45°. From determinations of the energy of the scattered electrons for different angles certain conclusions were drawn. Since low speed electrons are more easily deflected than α-particles, their scattering patterns depend not only on the field immediately about the nucleus but also upon its nature outside of the structural electrons. The complicated patterns for platinum would seem to indicate that there were several more or less definite concentrations of electrons at certain distances from the nucleus. The simple pattern obtained with magnesium would indicate a single concentration of electrons (the L group). These results for magnesium combined with a theory formulated by one of the authors (Davisson) indicate a concentration of 7 or 8 electrons in a shell having a radius of about 1.5×10^{-9} cm.

[1] Journal of the American Chemical Society, Vol. XLV, p. 2255, October, 1923.
[2] Physical Review, Vol. XXII, No. 3, Sept., 1923.

Supervisory Systems for Remote Control,[3] by C. E. Stewart[4] and J. C. Field.[5] The rapid development of power networks has made it desirable to supervise the various sources of power and make the different connections from one central supervisory or dispatching station. The basic requirements of such systems are taken up in this paper and the three methods by which they have been met are discussed. This apparatus enables the supervisor to control the generators and make all of the connections at all the plants. The control is accomplished by means of standard train dispatching selectors actuated by means of current impulses sent through the control circuits, which operate relays and supervisory lamps indicate the state of affairs on each circuit.

Telephone Transmission Over Long Lines,[6] by H. S. Osborne. In this paper are pointed out some of the similarities and contrasts of power transmission and telephone transmission over long distances. The transcontinental telephone line is discussed. The efficiency of this line has been materially increased by removing the loading coils and increasing the number of repeaters. Recent toll cable developments are described and a discussion is given of the problems involved in their design. Long cables are being used extensively where many circuits along the same route are necessary. They are particularly immune to destruction by sleet but require considerable auxiliary apparatus such as loading coils and repeaters. An outline is given of the results obtained in the commercial application of the carrier telephone and telegraph systems. Finally a demonstration talk between Havana, Cuba, and Avalon on Catalina

[3] Electrical World, Vol. LXXXII, pp. 655–659, Sept. 29, 1923.

[4] General Electric Company.

[5] Western Electric Company.

[6] Paper presented at the Pacific Coast Convention of the A. I. E. E., Del Monte, California, Oct. 2–5, 1923, and published in the Journal A. I. E. E., Vol. XLII, No. 10, October, 1923, also Elect. Communication, Vol. II, pp. 81–94, Oct., 1923.

Island, off the Pacific coast is described as an illustration of what can be done with modern telephony.

Recent Developments in Telephone Equipment for Train Dispatching Circuits,[7] by Wm. H. Capen. This paper presents in detail the recent developments in telephone equipment for train dispatching including a brief outline of its history up to the present time, the transmission requirements of dispatching circuits as compared to those of ordinary telephone circuits, together with the effect of the electrical characteristics of the line, number of sets, etc., on the proper design for maximum efficiency; curves which show the effect of these several variables on the efficiency, for open wire and loaded cable lines; the interesting phenomenon of "standing waves" and means for their elimination; diagrams showing the circuits for the dispatcher's and waystation sets; the development of the vacuum tube amplifier with loud speaker for both dispatcher and waystation use; diagrams and photographs illustrative of the apparatus discussed; discussion of the practical application and limitations of the present train dispatching apparatus. An appendix follows, giving in detail the development of certain mathematical formulæ used in the design of the apparatus.

Transatlantic Radio Telephony,[8] by H. D. Arnold and Lloyd Espenschied. The first transmission of the human voice across the Atlantic was accomplished by means of radio in 1915. Since that time substantial progress has been made in the art of radio telephony and in January of this year another important step was taken in the accomplishment of transoceanic voice communication. At a prearranged time telephonic messages were

[7] Paper presented at the Annual Convention of the Telegraph and Telephone Section of the American Railway Association, held at Colorado Springs, September 19, 1923, and published in Electrical Communication, Vol. II, No. 2, October, 1923.

[8] This paper, with the exception of the Appendix, was presented at the Annual Convention of the A. I. E. E., Swampscott, Mass., June 26–29, 1923, and was printed in the Journal A. I. E. E., Vol. XLII, No. 8, August, 1923, also Bell System Technical Journal, Vol. II, No. 4.

received in London from New York clearly and with uniform intensity over a period of about two hours.

These talking tests were part of a series of experiments on transatlantic telephony which are now under way, the results of which to date are reported in this paper.

A new method of transmission, radiating only a single side-band, is being employed for the first time. As compared with the ordinary method of transmission, this system possesses the following important advantages:

The effectiveness of transmission is greatly increased because all of the energy radiated is effective in conveying the message; whereas in the ordinary method, most of the energy is not thus effective.

The stability of transmission is improved.

The frequency band required for transmission is reduced, thus conserving wave length space in the ether and also simplifying the transmitting antenna problem.

An important element of the high-power transmitter is the water-cooled tubes, by means of which the power of the transmitted currents is amplified to the order of 100 kilowatts or more. The direct-current power for these tubes is supplied from a 60-cycle a-c. source through water-cooled rectifier tubes.

A highly selective and stable type of receiving circuit is employed. Methods and apparatus have been developed for measuring the strength of the electro-magnetic field which is delivered to the receiving point and for measuring the interference produced by static.

The transmission tests so far have been conducted on a wave length of 5,260 meters (57,000 cycles per second). The results of the measurements during the first quarter of the year on the transmission from the United States to England show large diurnal variations in the strength of the received signal and in the radio noise strength, as is to be expected, and correspondingly large diurnal variations in the ratio of the signal to noise strength and in the resulting reception of spoken

words. Also, the measurements, although as yet incomplete, show a large seasonal variation.

The character of the diurnal and seasonal variations is clearly indicated in the figures. The curves present the most accurate and complete data of this kind yet obtained.

Mutual Impedances of Grounded Circuits,[9] by George A. Campbell. Formulæ are derived for the direct-current mutual resistance and inductance between circuits grounded at the surface of the earth. For circuits composed of straight filaments, the mutual inductance is reduced to known Neumann integrals which involve only comparatively simple expressions for the case of horizontal, coplanar conductors above, below or on the surface of the earth. Numerical values for these integrals may be readily obtained from new and accurate graphs for straight filaments which meet at a point or start from a common perpendicular. It is shown that these new results supply a useful first approximation to the actual alternating-current mutual impedance of grounded circuits, when the frequency and extent of the circuits are not larger than occur in many practical applications.

Frequency Measurement in Electrical Communication,[10] by J. W. Horton, N. H. Ricker and W. A. Marrison. The need for increased accuracy in the measurement of any frequency between one and several million cycles per second is first considered.

A brief discussion of general types of frequency standards leads to the reasons for choosing a continuously operating generator of alternating current. The generator developed is, in effect, a regenerative system comprising a 100-cycle tuning fork, of low decrement, maintained in vibration by a vacuum tube amplifier.

The absolute value of the frequency of the alternating

[9] Published in Bell System Technical Journal, Vol. II, No. 4, October, 1923.

[10] Presented at the Annual Convention of the A. I. E. E., Swampscott, Mass., June 26–29, 1923. Abstract to be published in the Journal of A. I E. E.

current delivered by this generator is determined by counting the number of cycles executed in an accurately known time. A small synchronous motor is used for making this count. Recording apparatus for comparing the rate of the fork with various time indicators is described.

Data are given showing the effect upon the frequency of such external conditions as temperature, potential of power supply, circuit constants of the amplifier and vacuum tubes. This information is obtained either by comparisons with a constant frequency or by determinations of the absolute value of the frequency. The ratio of the rate of the fork to the rate of a carefully maintained clock has been found to be constant to within six parts in 1,000,000 over considerable periods of time.

For measuring the frequency of any alternating current used in electrical communication in terms of the known frequency there has been developed a decade arrangement of harmonic producers and a special modulator-rectifier circuit for combining known harmonics of the base and comparing other frequencies with them. These circuits are described in detail.

Thermionic Vacuum Tubes and Their Application,[11] by Robert W. King. The material presented is a compendium of the past work on the applications of both the two electrode and three electrode vacuum tubes. Though it is treated almost entirely from the practical point of view with practically no derivation of formulæ, a very complete bibliography is given as footnotes. Following an introduction in which the fundamentals are discussed, chapters are devoted to two electrode tubes, three electrode tubes, amplifiers, amplifier power supply, amplifier troubles, modulators, detectors, oscillators, and miscellaneous applications.

A Variable Aperture Rotating Sectored Disc,[12] by

[11] Bell System Technical Journal, Vol. II, No. 4, October, 1923.

[12] Journ. of Opt. Soc. and Rev. of Scientific Instruments, September, 1923.

Herbert E. Ives. "Two sector discs, in sliding contact with each other, are driven, by means of two idlers, in the opposite direction to the motion of the driving shaft on which they are loosely carried. One idler is fixed, the other can be moved about the shaft as a center by means of a worm, thus altering the relative positions of the two discs and so increasing or decreasing the opening of the compound disc. The opening is read off directly from the angular position of the movable idler."

Notes on Recent Occurrences

GENERAL ACCOUNTING CONFERENCE

FROM October 8th to 13th, inclusive, a conference was held at Briarcliff Lodge, Briarcliff Manor, N. Y., attended by the General Auditors and Chief Accountants of the Associated Companies and by representatives of the American Telephone and Telegraph Company, the Western Electric Company, the Northern Electric Company, and the Bell Telephone Securities Company. Mr. C. A. Heiss, Comptroller of the American Telephone and Telegraph Company, welcomed the conferees on behalf of the parent company.

The program was a lengthy one and provided a busy and profitable week. The general theme which ran through the discussion related to the ways in which the Accounting Departments can render the greatest assistance to the other departments and can contribute most effectively to the management of the business as a whole, both through the maintenance of adequate records and through the expansion of the processes of statistical analysis and presentation of the facts shown by the records. A number of technical accounting subjects were covered, such as the development of accounting methods, field disbursement practices, the handling of Western Electric bills and credits, and revenue accounting administration and practices; a considerable amount of time was also devoted to such matters as methods of developing statistical work, exchange statistics, budgetary control and the correlation of the construction program with Western Electric Company sales.

There was also a discussion of depreciation accounting and attention was directed to the general Bell System practice in respect of pricing re-usable material and its effect upon the plant and depreciation reserve accounts. On October 9th, Mr. N. T. Guernsey, Vice President and

General Counsel of the American Telephone and Telegraph Company, addressed the Conference upon the subject of depreciation and showed how the difficulties usually raised are swept away by accurate thinking concerning the fundamentals.

President Thayer and Vice President Gifford also spoke to the Conference. Mr. Gifford pointed out the necessity for the constant development of "the process of analyzing the accounts and analyzing the figures so as to make it possible for the executive to see the significant thing." Mr. Thayer referred to the Accounting Department as not only the fact-gathering department of the business, but the fact-interpreting and fact-distributing department of the business.

THE PERSONNEL CONFERENCE

BROADENED and more detailed discussion of telephone activities from the viewpoint of operating technique was the feature of the General Personnel Conference of the Bell System, held at Rye Beach, New Hampshire, October 24–31, 1923, presided over by Mr. E. K. Hall, Vice President of the American Telephone and Telegraph Company.

Unlike the last personnel conference at which public relations *per se* was the major theme, the meeting at Rye Beach brought out a large number of activities directly connected with the successful consummation of operating objectives.

This definiteness, which made the conference especially suggestive to the 128 members and guests in attendance, was fostered by the meeting's plan of organization which provided for a program of three separate sections, covering General, Plant, and Traffic matters. This arrangement also made it possible for operating officials to attend either all the sessions or those pertaining more specifically to their personal responsibilities.

Of particular interest were the reports describing various plans of employee representation now in effect, given by those directly responsible for operating results, and the plans outlined by others for working with Joint Conference Committees in 1924.

The features of the General Sessions included a paper by Mr. G. M. Welch, Vice President and General Manager of the Michigan Bell Telephone Company, and talks by Mr. J. C. Nowell, Vice President of the Pacific Telephone and Telegraph Company; Mr. C. F. Sise, Vice President and General Manager of the Bell Telephone Company of Canada; Mr. Burdett Stryker, General Manager of the Chesapeake and Potomac Telephone Company; Mr. A. A. Lowman, Vice President and General Manager of the Northwestern Bell Telephone Company; Mr. J. C. Lynch, Vice President of the Bell Telephone Company of Pennsylvania; Mr. G. H. Dresser, General Manager of the New England Telephone and Telegraph Company; Mr. F. H. Reid, Vice President of the Southern Bell Telephone and Telegraph Company; Mr. F. O. Hale, Vice President and General Manager of the Illinois Bell Telephone Company; Mr. J. S. McCulloh, Operating Vice President of the New York Telephone Company; Mr. H. C. Knight, Vice President and General Manager of the Southern New England Telephone Company. These speakers all dealt with personnel activities and employee representation from the viewpoint of the general management.

During the Plant sessions papers were presented by Mr. R. H. Burcher, Assistant Vice President of the American Telephone and Telegraph Company; Mr. F. L. Redmund, General Plant Superintendent of the Illinois Bell Telephone Company; Mr. H. Hamilton, General Superintendent of Plant of the Chesapeake and Potomac Telephone Company and interesting outlines of management programs for 1924 were given by Messrs. W. H. Winter, General Plant Manager of the Bell Telephone Company of Canada; L. Killam, General Plant Super-

intendent of the Wisconsin Telephone Company; F. M. Stephens, General Superintendent of Plant of the Ohio Bell Telephone Company; E. L. Simonds, General Superintendent of Plant of the Southern New England Telephone Company; T. G. Miller, General Plant Manager, Long Lines Department of the American Telephone and Telegraph Company; G. C. Allen, General Plant Manager of the New York Telephone Company.

The Traffic sessions provided interesting papers from Mr. K. W. Waterson, Assistant Chief Engineer of the American Telephone and Telegraph Company; Mr. A. C. Stannard, General Traffic Manager of the Southwestern Bell Telephone Company; Mr. W. F. Cozad, General Superintendent of Traffic of the Northwestern Bell Telephone Company, and Mr. M. D. Sedam, General Superintendent of Traffic of the Chesapeake and Potomac Telephone Company, and brief outlines of management's programs for 1924 from Messrs. J. H. Brace, General Superintendent of Traffic of the Bell Telephone Company of Canada; F. E. Chandler, General Traffic Superintendent of the Wisconsin Telephone Company; F. E. Moore, General Superintendent of Traffic of the Southern New England Telephone Company; R. Eide, Vice President of the Ohio Bell Telephone Company; C. R. Woods, General Superintendent of Traffic of the Indiana Bell Telephone Company; R. F. Estabrook, General Traffic Manager of the New England Telephone and Telegraph Company; J. P. Downs, General Traffic Manager of the New York Telephone Company.

In summing up the papers and discussions of the General sessions, Mr. Bancroft Gherardi, Vice President and Chief Engineer of the American Telephone and Telegraph Company, suggested that perhaps the time had arrived when personnel plans might be budgeted and then checked up, in the manner that other operating undertakings are planned in advance and supervised. He said it was most desirable that personnel officials

have an intimate knowledge of operating problems and objectives and continuous contact with the operating forces. He stated further in this connection that consideration was being given to the idea of consolidating future personnel conferences with Plant and Traffic conferences so that personnel matters might be discussed by all concerned at the same time.

In reviewing the progress of the past three years in personnel work, Mr. E. K. Hall discussed some of the problems connected with functional machinery for employee representation, suggested advance planning of definite programs for discussion by management representatives in Joint Conference Committees, and mentioned many matters that might be thus considered.

One session of the conference was informally addressed by Mr. H. B. Thayer, President of the American Telephone and Telegraph Company. In referring to personnel work Mr. Thayer said, "And so in all departments, whether it is collecting bills or giving service, whether it is installing a telephone or trimming trees in front of a man's property, there is no question in my mind but that we must have every man and woman in our business feel that they are working for the public, that they have got to please the public. And the only way for them to have that feeling is for them to feel that they are the business,—not merely that they are working for the business but that they actually are the business. There is nothing too strong that I could say concerning my belief in the importance of this personnel work."

MR. BANCROFT GHERARDI DECORATED BY JAPANESE EMPEROR

THE Emperor of Japan has conferred upon Mr. Bancroft Gherardi, Vice President and Chief Engineer of the American Telephone and Telegraph Company, the fourth class of the Imperial Order of the Rising Sun.

According to the letter of advice, the decoration is in recognition of assistance which Mr. Gherardi and the company have given to Sannosuke Inada, Chief Engineer of the Japanese Department of Communications, and the members of his staff, who have been investigating telephone engineering. The decoration itself is being transmitted through the Japanese Ambassador.

EUGENE A. REED

EUGENE A. REED, president of the Ohio Bell Telephone Company, died at Columbus, O., on November 20.

He was born in Boston, Mass., on February 9, 1871, and received his education in the public schools of that city and in Harvard University, from which he was graduated with the degree of A.B., in 1892. Following his college course he studied law at Harvard Law School for nearly two years, but terminated his work there in 1894 to enter the service of the American Telephone and Telegraph Company at Boston, as assistant chief operator in the Boston Long Lines operating office. He later served as chief operator, chief clerk to the district superintendent, and assistant district superintendent.

In 1899 he was transferred to New York City, where he served successively as assistant district superintendent of the old First District of the American Telephone and Telegraph Company, as manager of the New York long lines station, and as special agent in charge of traffic work.

In 1903, he became division superintendent and later general superintendent and general manager of the Ohio division of the Central Union Telephone Company, with headquarters at Columbus. In 1911 he went to Chicago, to act as general plant superintendent of the Central Group organization, but in July, 1912, he returned to Columbus to his previous duties as general manager of the Ohio division, and as general manager of the Cleve-

land Telephone Company. This latter post he resigned in 1914 in order to devote his entire time to Central Union affairs.

In January, 1920, Mr. Reed was elected a director and vice president of the Cleveland Telephone Company. When this company became a part of the Ohio Bell Telephone Company, he was retained as vice president and became its president after its merger with the Ohio State Telephone Company.

EMPEROR OF JAPAN BESTOWS DECORATION ON DR. F. B. JEWETT

DR. F. B. JEWETT, Vice President of the Western Electric Company, has been decorated with the fourth class of the Imperial Order of the Rising Sun by the Emperor of Japan. Notice of the honor has come directly from Sannosuke Inada, Chief Engineer of the Japanese Department of Communications. In a letter to Dr. Jewett, Mr. Inada has written, "The assistance which you and your company are rendering to the government of Japan is gratefully acknowledged by this order." Recognition is made not only of assistance after the earthquake, but over a period of years in the field of telephone engineering. The award to Dr. Jewett is unusual in that the Order is usually bestowed only upon those who have actually visited Japan.